Unit 9
Trigonometry

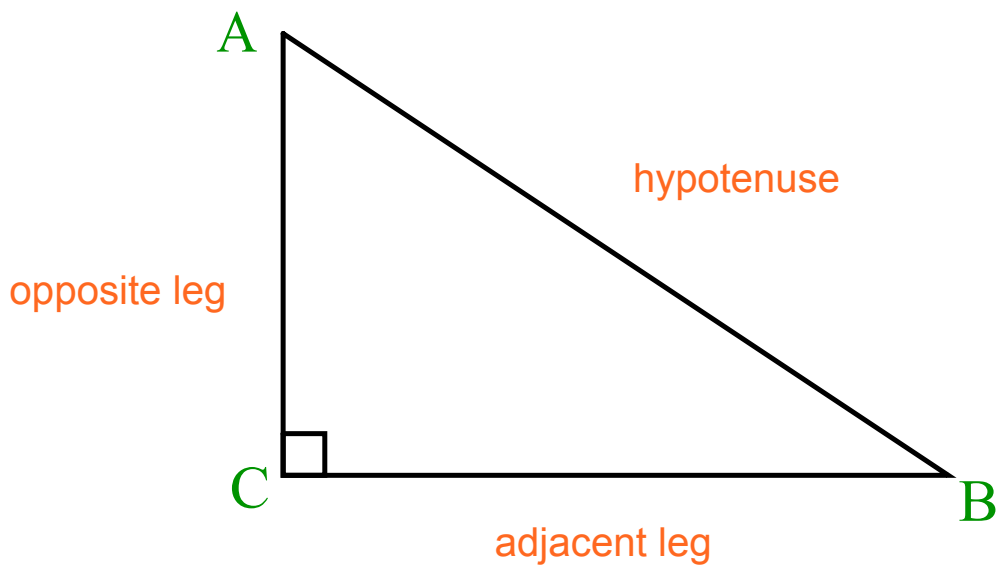
I. Trigonometry

8.3

A. Trigonometry: relationships between angles and sides of right triangles.

B. To find the measure of a side of a right triangle:

1. Pythagorean Theorem (exact)
   2 sides....find the third side
2. Special Right Triangles (exact)
   1 side and 1 special angle...find other sides
3. Trig Functions (estimated)
   1 side and 1 acute angle...find other sides and/or angles


A
hypotenuse
opposite leg
C
B
adjacent leg

C. Trig Functions - a proportion used to find measure of sides or angles

*Only use with right triangles

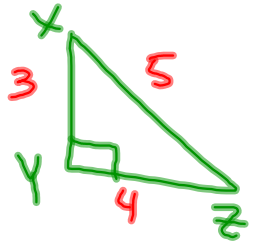
*Only use with the acute angles

1. Sine of an < = $\frac{\text{opposite leg}}{\text{hypotenuse}}$

2. Cosine of an < = $\frac{\text{adjacent leg}}{\text{hypotenuse}}$

3. Tangent of an < = $\frac{\text{opposite leg}}{\text{adjacent leg}}$

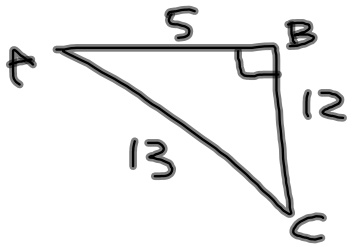
SOH- CAH-TOA S = O/H C = A/H T = O/A



$\sin Z =$

$\cos X =$

$\tan Z =$



$\tan \_\_ = \frac{5}{12}$

$\cos C =$

$\cos \_\_ = \frac{12}{13}$

$\sin A =$

$\tan A =$

Use table in back of Geometry book to find:

Sin 45	Sin x = .3584
cos 57	tan A =1.4826
tan 79	cos B = .7000
cos 3	tan B = 4.134
Sin 87	sin A = .9898

Now use the calculator

Sin 45

cos 57

tan 79

cos 3

Sin 87

sin A = .9898

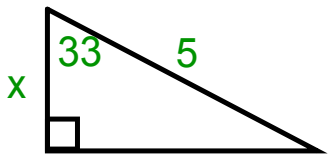
tan A = 1.4826

sin x = .3584

cos B= .7000

Examples:angles to the nearest degree, sides to the nearest tenth

1.



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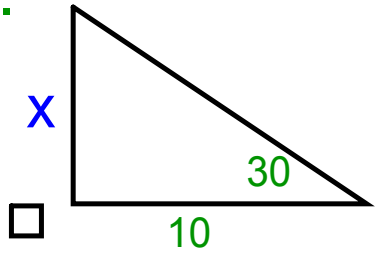

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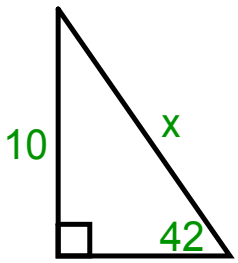

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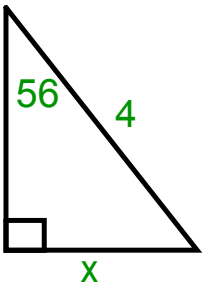

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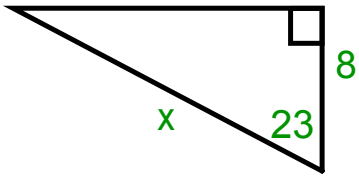

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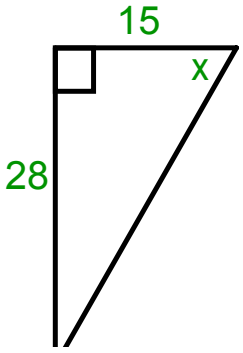

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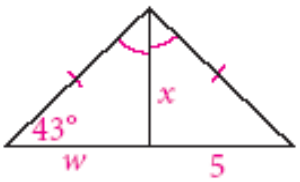
27.



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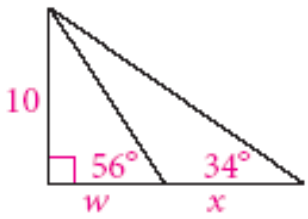

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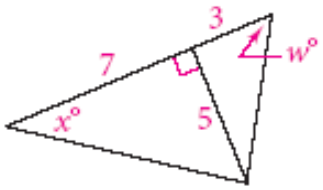

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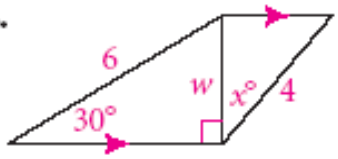

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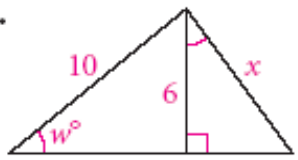

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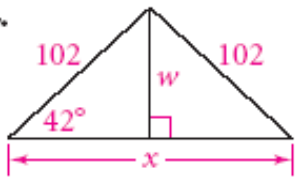
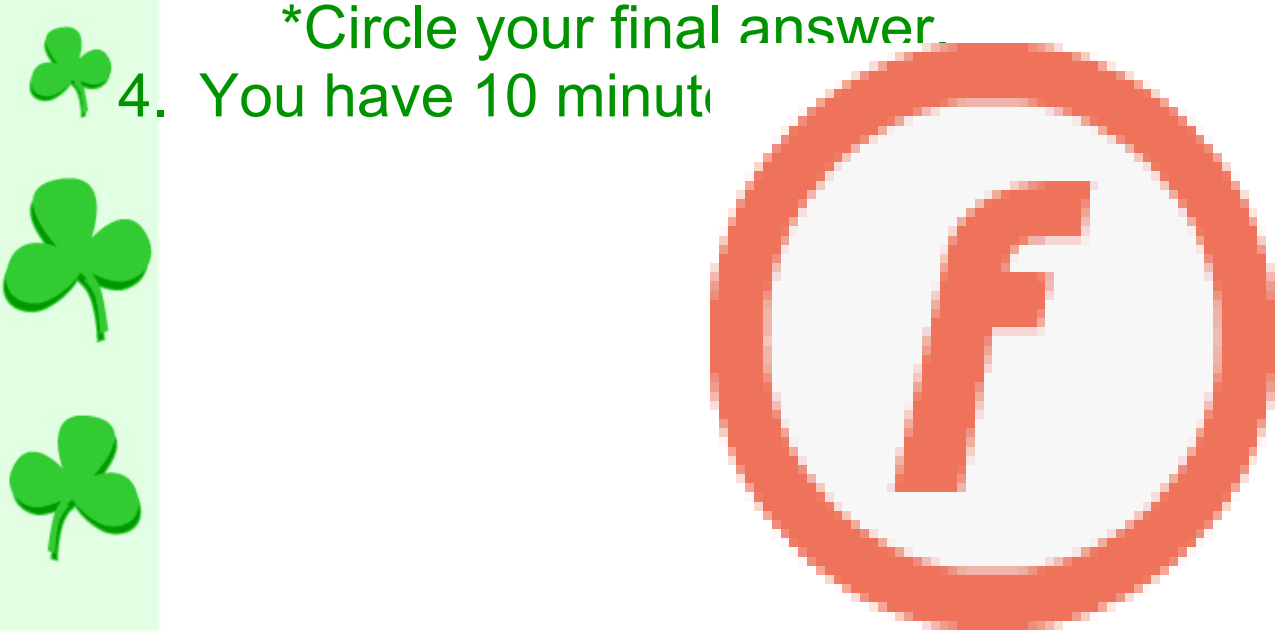
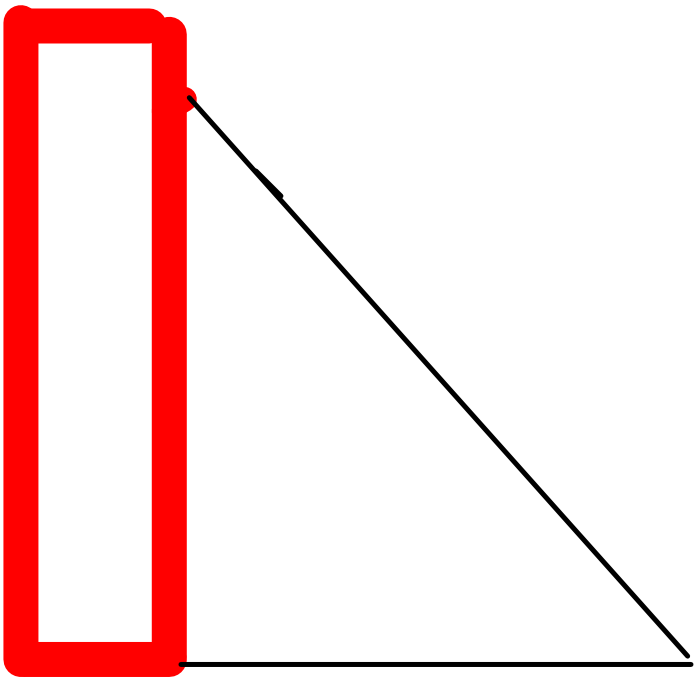


POP QUIZ

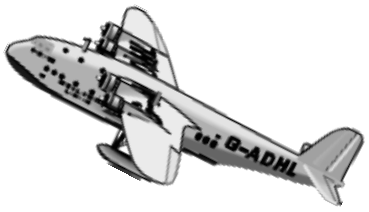
1. Clear your desk
2. Get your pencil and calculator
3. Show all your work.
   *Round answers to the hundredths.
   *Circle your final answer.
4. You have 10 minut



A 16 ft ladder is propped against a building. The angle it forms with the ground is 55 degrees. How far up the side of the building does the ladder reach?



A jet takes off and rises at an angle of 19 degrees with the ground until it hits 28,000 feet. How much ground distance is covered in miles?



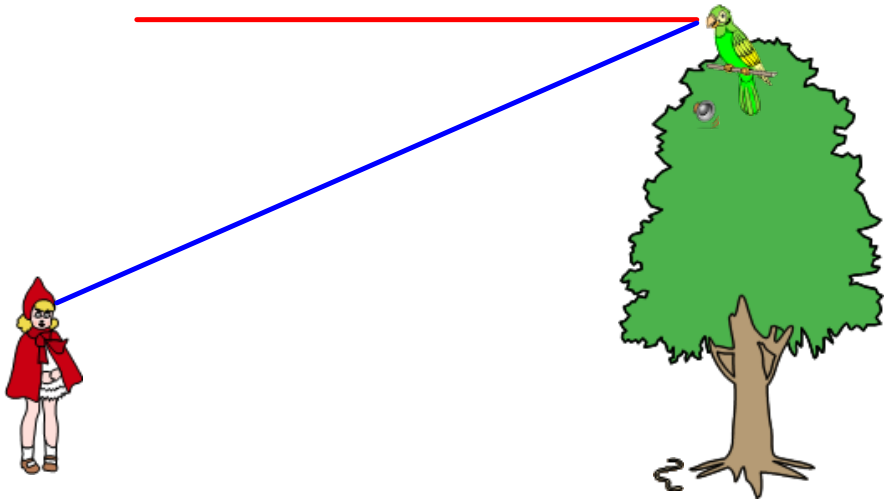
8.4

II. Applying Trig Functions

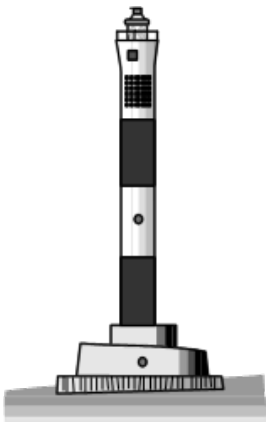
A. line of sight

B. angle of elevation

C. angle of depression

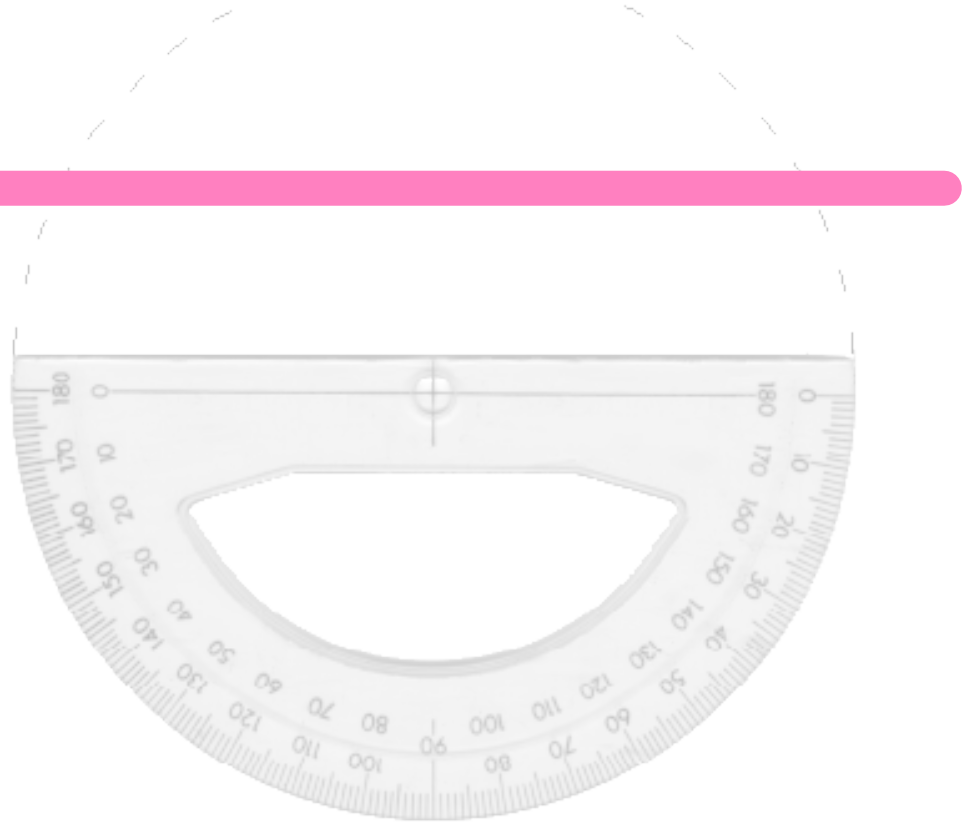


Ex 1: A boat spots the top of a lighthouse at an angle of elevation of 28°. If the lighthouse is 150 feet tall, how far will the boat have to travel to reach the lighthouse?



Ex 2: From the top of a lighthouse, the angle of depression to a buoy is 25°. If the top of the lighthouse is 150 feet above sea level, what is the distance between the buoy and the foot of the lighthouse?

Danny is in the observation area of Sears tower in Chicago overlooking Lake Michigan. She sights two sailboats going due east from the tower. The angles of depression to the two boats are 42 degrees and 29 degrees. If the observation deck is 1,353 feet high, how far apart are the two boats?



III. Area of regular polygons

A. Regular polygon is equlateral and equiangluar.

B. Area formula for any regular polygon:

$$A = \frac{1}{2} Pa$$

*P = perimeter

*a = apothem

Ex 1: Find the area of a regular hexagon with 6 cm sides.

Ex 2: Find the area of a regular decagon with 8 cm sides.

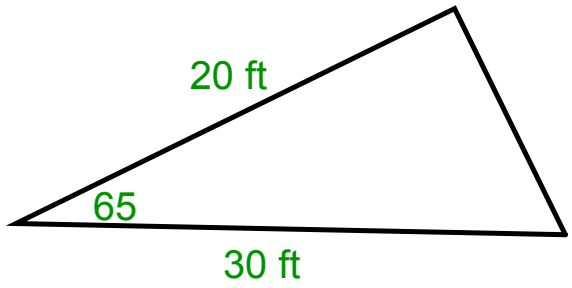
Ex 3: Find the area of a regular heptagon with 5 cm sides.

Ex 4: Find the area of a regular nonagon with 8 cm radius.

IV. Area of Triangles

A. Area of any triangle

$A = 1/2\ bh$

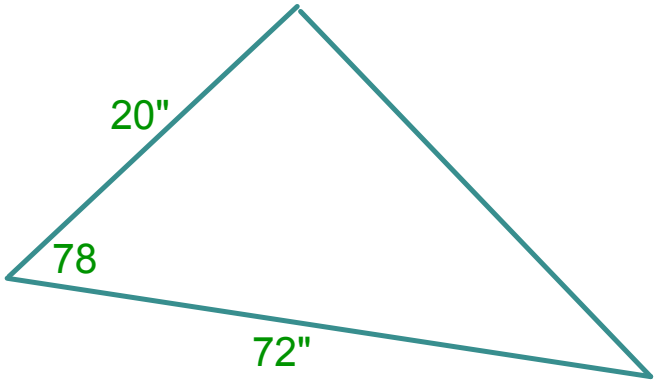


B. Given two sides and the included < find the area by:

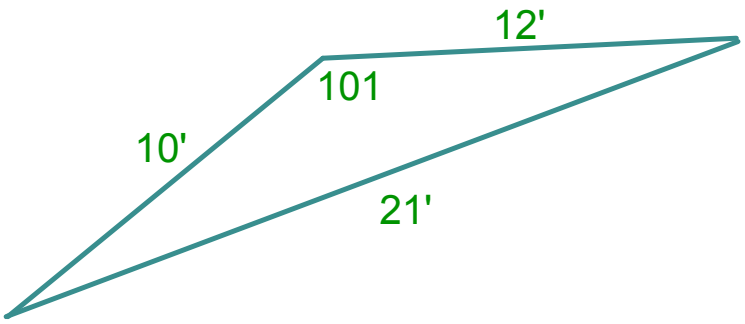
$A = 1/2$ (side)(side)(Sin included <)

A = 1/2 (side)(side)(Sin included <)

Ex #1



Ex #1



V. Law of Sines and Cosines
(Use with any triangle)

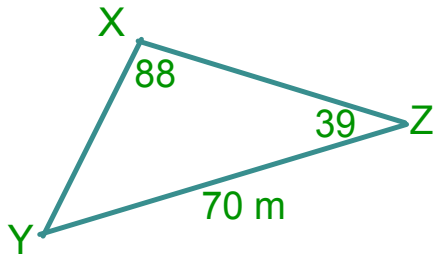
A. Law of Sines

*In order to use law of sines you must have an angle and the side opposite the angle.

$$\frac{SinA}{a} = \frac{SinB}{b} = \frac{SinC}{c}$$

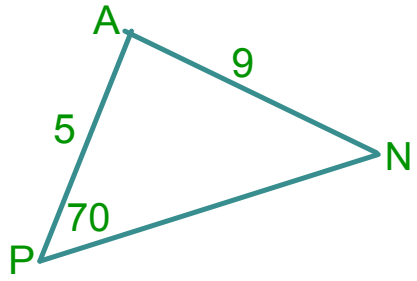
$$\frac{SinA}{a} = \frac{SinB}{b} = \frac{SinC}{c}$$

Ex #1: Solve the triangle



<X = _____ x = _____
<Y = _____ y = _____
<Z = _____ z = _____

Ex #2 Solve the triangle



<P = _____ p = _____

<A = _____ a = _____

<N = _____ n = _____

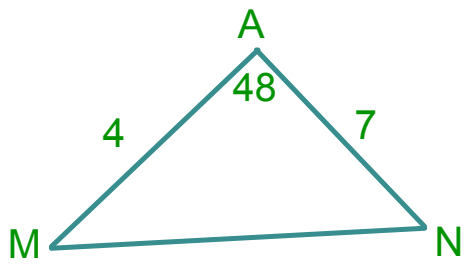
B. Law of Cosines
(Not able to use law of sines...not given the angle and opposite side)

$$a^2 = b^2 + c^2 - 2bc\ (\cos A)$$
$$b^2 = a^2 + c^2 - 2ac\ (\cos B)$$
$$c^2 = a^2 + b^2 - 2ab\ (\cos C)$$

*Only use law of cosines once to find the angle or side opposite each other.
*Then use law of sines to complete solving the triangle

$$a^2 = b^2 + c^2 - 2bc\ (\cos A)$$
$$b^2 = a^2 + c^2 - 2ac\ (\cos B)$$
$$c^2 = a^2 + b^2 - 2ab\ (\cos C)$$

Ex #3: Find a



Homework: Solve the triangle ABC

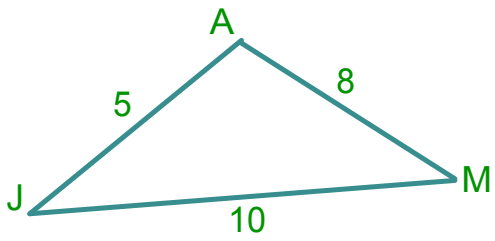
1. a = 12 m
   m<B = 70
   m<C = 15

2. a = 5 cm
   c = 4 cm
   m<A = 65

3. a = 16 in
   b = 20 in
   m<B = 40

4. a = 42 mm
   c = 60 mm
   m<B = 58

Ex #4: Solve the traingle

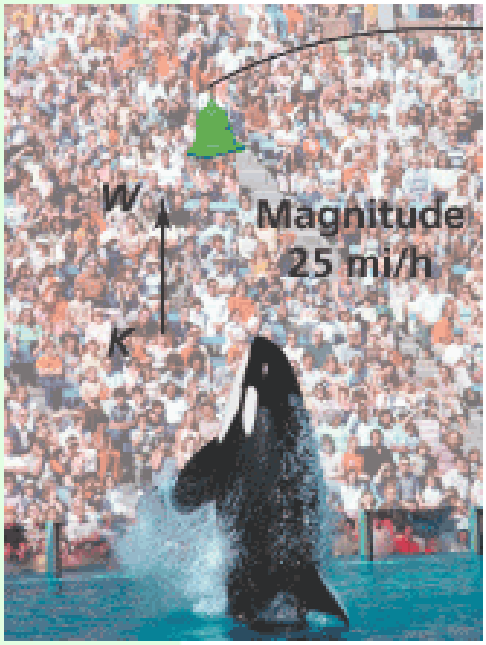


$$a^2 = b^2 + c^2 - 2bc\ (\cos A)$$
$$b^2 = a^2 + c^2 - 2ac\ (\cos B)$$
$$c^2 = a^2 + b^2 - 2ab\ (\cos C)$$

VI. Vectors

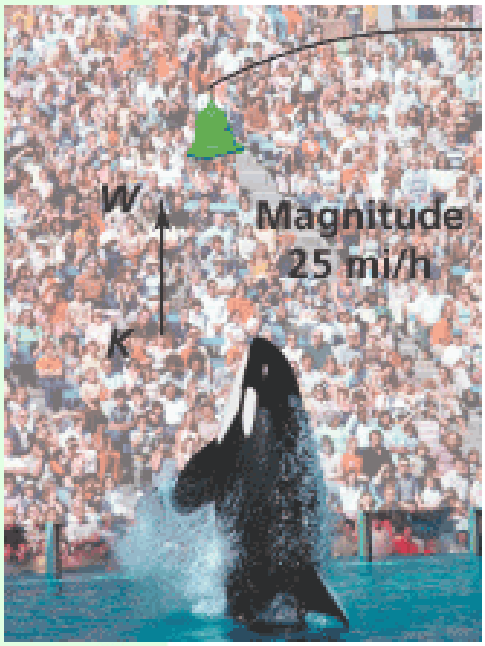
A. Vector: any quantity with magnitude (size) and direction.

$\overrightarrow{KW}$



B. Initial Pt : beginning point (pt K)

C. Terminal Pt : ending point (pt W)

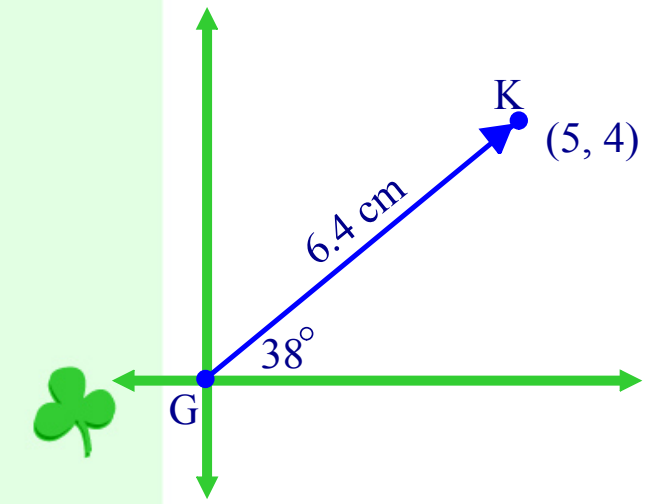


D. Magnitude:distance between the initial and terminal points

*Magnitude can represent rate or speed.

E. Direction: way the arrow points.

F. Amplitude: directed angle between the x-axis and the vector.

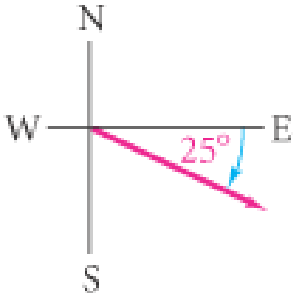


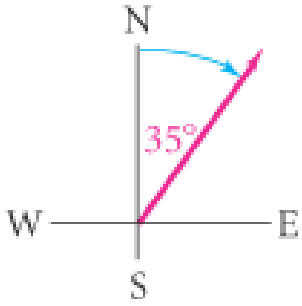
Component form: $\overrightarrow{GK} = \langle 5, 4 \rangle$
(ordered pair representation)

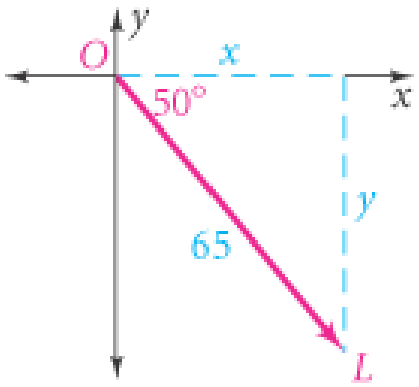
Magnitude: 6.4 cm

Amplitude (direction): 38° north of east

Describe the amplitude of each vector.



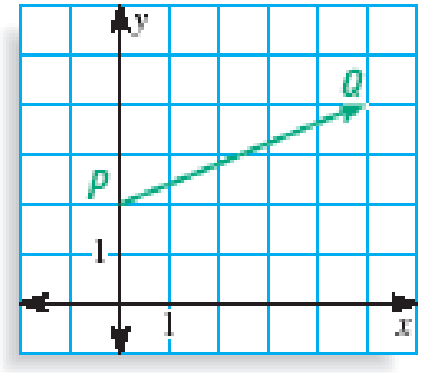




What is the magnitude?

What is the amplitude?

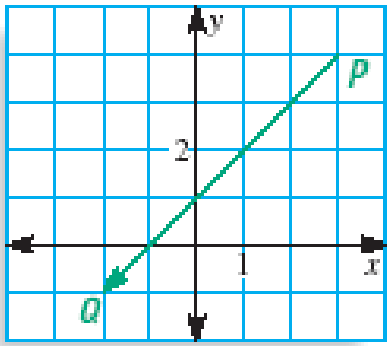
Write the component form of this vector.



Component Form:

Magnitude:

Amplitude:

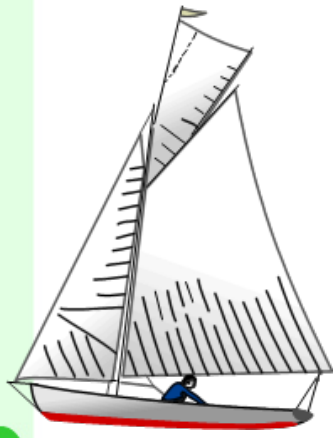


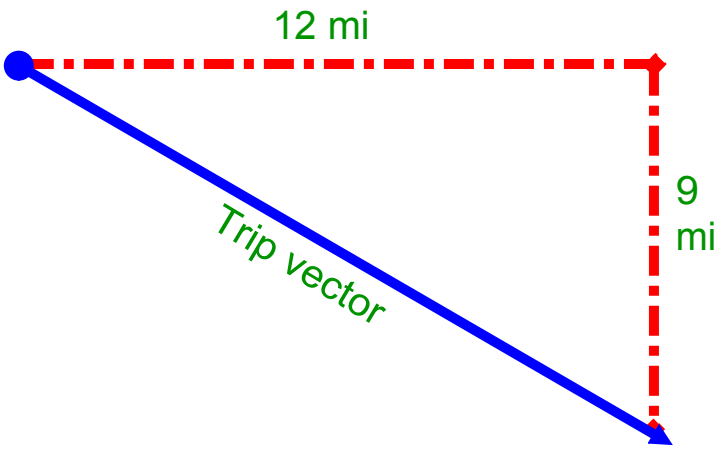
Component Form:

Magnitude:

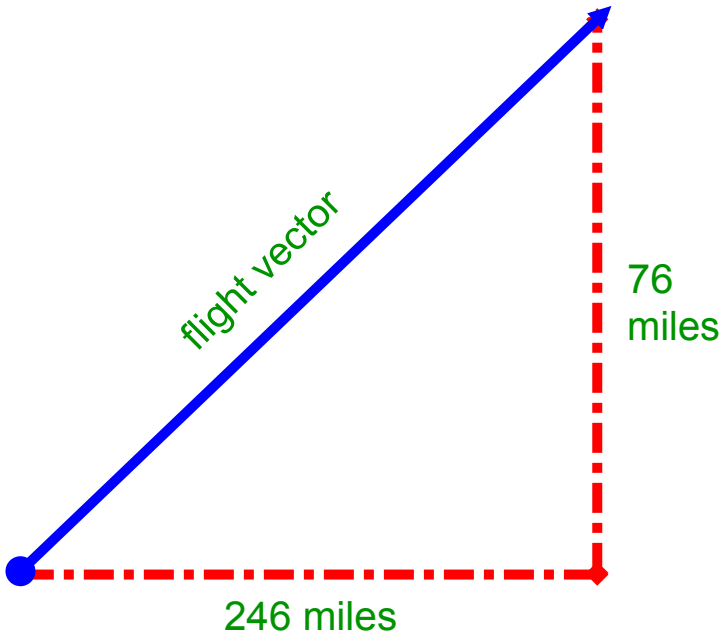
Amplitude:

A boat sailed 12 miles east and 9 miles south. Describe the trip vector.



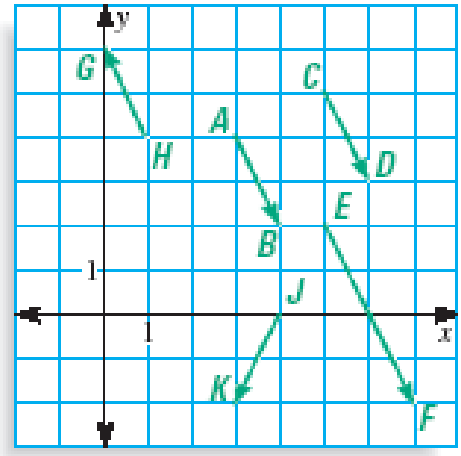


A small plane lands at a point 246 miles east and 76 miles north of the point where it took off. Describe the flight vector.



G. Equal vectors: vectors with the same direction and magnitude.

H. Parallel Vectors: same or opposite directions but have the same amplitude (< measure)



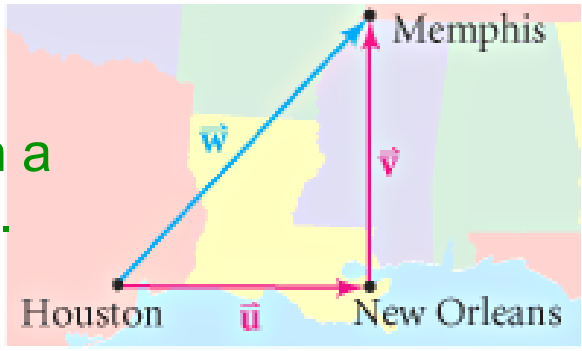
These vectors are equal:

$\overrightarrow{AB}, \overrightarrow{CD}$.

These vectors are parallel:

$\overrightarrow{AB}, \overrightarrow{CD}, \overrightarrow{EF}, \overrightarrow{HG}$.

The map shows vectors representing a flight from Houston to Memphis with a stopover in New Orleans.



The vector from Houston directly to Memphis is called the **resultant vector**.

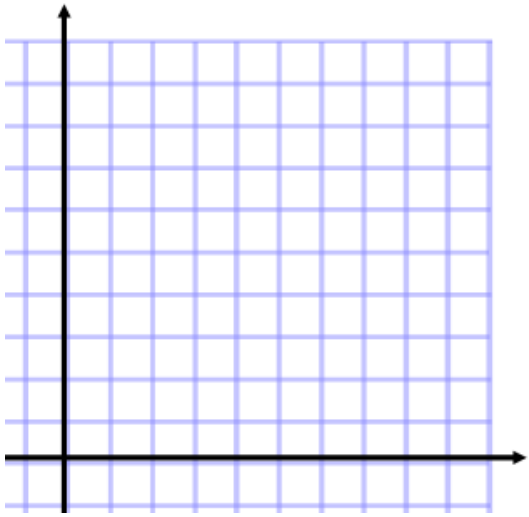
I. Resultant Vector: sum of two vectors

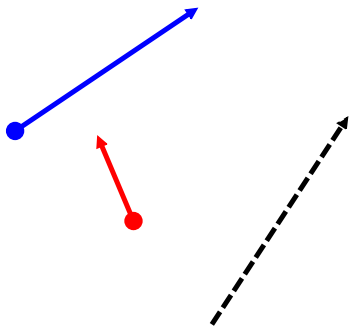
For $\mathbf{a} = \langle x_1, y_1 \rangle$ and $\mathbf{c} = \langle x_2, y_2 \rangle$, $\mathbf{a} + \mathbf{c} = \langle x_1 + x_2, y_1 + y_2 \rangle$.

Ex: $\vec{u}$ = <4, 3> and $\vec{v}$ = <-1, 2>

resultant: $\vec{w}$ = <4 + -1, 3 + 2> = <3, 5>

Graphical representation:

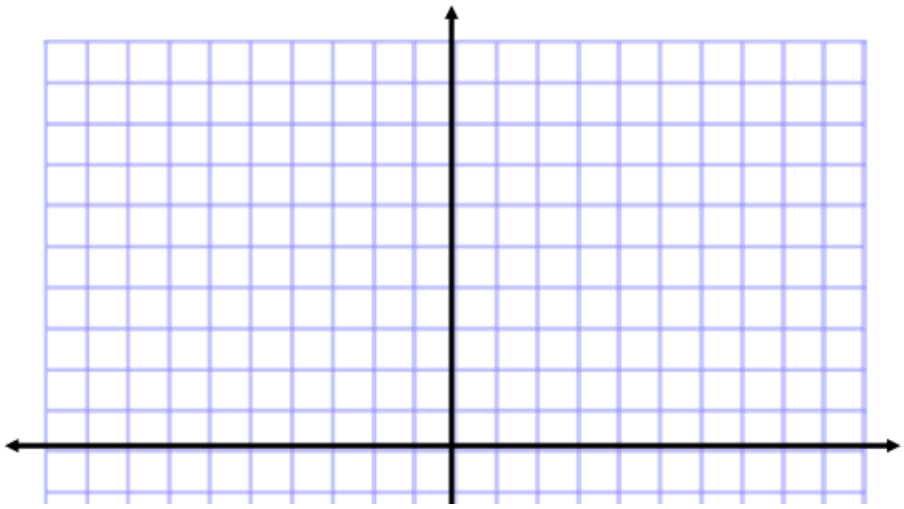




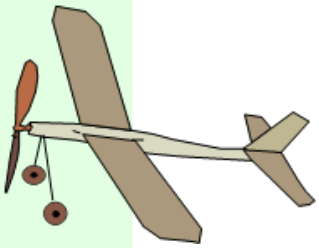
Ex: $\vec{u}$ = <-5, 3> and $\vec{v}$ = <7, 5>

resultant: $\vec{w}$ =

Graphical representation:



VII. Application of Vectors



Plane's speed is 250 mph in still air. The wind is blowing due east at 20 mph. If the plane heads due north, what is the resultant speed and direction?

In still air, a plane flies 374 mph. Suppose the plane flies due west and meets a hurricane wind blowing due south at 95 mph. What is the resultant speed and direction?